

SAFETY ELEMENT
WEST HOLLYWOOD GENERAL
PLAN

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UNIVERSITY OF CALIFORNIA

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TABLE OF CONTENTS

1.0 INTRODUCTION

- 1.1 Purpose
- 1.2 Related Laws, Regulations, and Codes

2.0 SETTING

- 2.1 Geographic Setting
- 2.2 Geologic Setting
- 2.3 Geo-Tectonic Setting
- 2.4 Groundwater Regime

3.0 SEISMIC HAZARDS

- 3.1 Ground Surface Rupture
- 3.2 Seismic Source Faults
- 3.3 Ground Shaking
 - 3.3.1 *UBC Design Spectra*
 - 3.3.2 *Peak Ground Acceleration*
 - 3.3.3 *Modified Mercalli Intensity Scale*
- 3.4 Seismically Induced Hazards
 - 3.4.1 *Liquefaction*
 - 3.4.2 *Lateral Spread*
 - 3.4.3 *Seismically Induced Settlement*
 - 3.4.4 *Landslides*
 - 3.4.5 *Tsunamis*
 - 3.4.6 *Seiches*

4.0 NON-SEISMIC GEOLOGIC HAZARDS

- 4.1 Mudslides
- 4.2 Landslides
- 4.3 Expansive Soils and Rock
- 4.4 Collapsible Soils
- 4.5 Ground Subsidence

5.0 FLOOD AND INUNDATION

6.0 URBAN FIRES

7.0 BUILDING INVENTORY

8.0 EMERGENCY RESPONSE

9.0 PLANNING FOR POST-DISASTER RECOVERY

Tables

- Table 1. Characterization of Faults Considered Significant to Seismic Shaking Hazard in the City
- Table 2. Summary of Historic Earthquakes with Magnitudes Greater Than 5.0 and Epicentral Distances of Less Than 100 km
- Table 3. Recurrence Intervals of Maximum Credible Earthquakes in the Southern California Area

Table 4. Modified Mercalli Intensity Scale

Table 5A. Relative Impact of Selected Earthquakes on the City (Soil Sites)

Table 5B. Relative Impact of Selected Earthquakes on the City (Rock Sites)

Figures

Figure 1. Map of Soil and Rock Sites in the City of West Hollywood

Figure 2. Southern California Fault Map

Figure 3. Fault Location and Precaution Zone Map

Figure 4. Earthquake-Induced Liquefaction and Landslide Hazard Map

Figure 5. Flood Hazard Map

Technical Appendix

1.0 INTRODUCTION

1.1 Purpose

This safety element is intended to identify the key seismic, geologic, flood, and fire hazards affecting the City of West Hollywood (City) so that geologic and engineering studies are performed to properly and adequately mitigate the potential for injury, death, damage to public and private property, and economic and social dislocation. This safety element also includes an assessment of building inventory and emergency response procedures.

This safety element, including maps tables, and appendices, replaces the preceding (1984) Seismic Element (Chapter 14) of the City's General Plan. This safety element is distinct from the Safety Element for the Los Angeles County General Plan (1990), which includes the City of West Hollywood.

Seismic hazards appear to pose the greatest threat to the City. The primary seismic hazards have been identified as:

- ◆ Ground shaking, including localized site response;
- ◆ Surface displacement of faults; and
- ◆ Liquefaction and related ground failure phenomena caused by strong ground shaking.

Revisions to the Safety Element, particularly seismic hazards, are based on a variety of new data, including:

- ◆ Characterization of seismic source faults, especially "blind" thrust faults;
- ◆ Updated seismic attenuation relationships used to evaluate the magnitude of ground shaking;
- ◆ Recent fault studies used to specifically evaluate the location and recency of activity of the Hollywood and Santa Monica faults;
- ◆ A compilation of groundwater levels and general subsurface conditions beneath the City reported by various geologic and geotechnical professionals; and
- ◆ Seismic hazard maps published by the State of California Division of Mines and Geology (CDMG).

1.2 Related Laws, Regulations, and Codes

The provisions of this safety element are intended to be in accordance with the following State of California or Federal laws and local building code regulations:

- ◆ Alquist-Priolo Earthquake Fault Zoning Act of 1972
- ◆ California Seismic Hazards Mapping Act of 1990 (2000 Latest map)
- ◆ Uniform Building Code, LA County Provisions (1997 latest edition)
- ◆ California Building Code (1998 latest edition)
- ◆ FEMA Flood Insurance Program (1987 latest map)

In addition, the following documents provide guidelines for geologic and engineering studies related to this safety element:

- ◆ CDMG SP-42: Fault Rupture Hazard Zones in California
- ◆ CDMG Note 49: Guidelines for Evaluating the Hazard of Surface Fault Rupture
- ◆ CDMG SP-117: Guidelines for Evaluating and Mitigating Seismic Hazards in California
- ◆ CDMG SP-118: Recommended Criteria for Delineating Seismic Hazard Zones in California

2.0 SETTING

2.1 Geographic Setting

The City is located along the southern edge of the Santa Monica Mountains, about 7-1/2 miles northwest of downtown Los Angeles. The City is approximately 3 miles long in a west-east direction and 1/2 to 1-1/3 miles wide in a north-south direction.

The topography within the City is relatively flat and sloped to the south except at the extreme northern margin of the City, which is at the base of the mountains. The maximum elevation is about 500 feet and the minimum elevation is about 160 feet. The average downslope gradient from north to south, not including the base of the mountains, is about 6 percent in the northern 1/3 of the City and about 2 percent in the southern 2/3 of the City.

2.2 Geologic Setting

West Hollywood is located largely on alluvial soil derived from the adjacent Santa Monica Mountains. As shown on Figure 1, the northernmost portion of the City is underlain by igneous and metamorphosed sedimentary bedrock. The alluvium consists of a mixture of sand, silt, clay, and gravel. The thickness of alluvium ranges from tens of feet in the vicinity of Sunset Boulevard on the north to hundreds of feet along the southern margin of the City.

Prior to development, a marsh existed within the alluvial plain currently incorporated as the City. The withdrawal of groundwater via pumping in the 1920's from this area contributed to the drying of the marsh. However, soft clays and organic-rich sediments

were likely deposited along with sand and silt in this area while the marsh was present. The approximate extent of this historic marsh is shown on Figure 1.

2.3 Geo-Tectonic Setting

The City is located in a highly active seismic region of southern California. Earthquakes occur when zones of weakness, or faults, in the Earth's crust move past one another in an abrupt or sudden way. Earthquakes can cause damage to property directly by ground displacement from fault rupture and strong ground shaking or indirectly as strong ground shaking causes ground failure such as landslides, liquefaction, or lateral spread.

Figure 2 shows the City relative to the mapped active and potentially active faults in southern California. The earthquake activity in the area stems from the relative movement of two great crustal plates: the Pacific and the North American Plates. The Pacific Plate, which includes the southwestern portion of California, including the Los Angeles Basin, is moving to the northwest relative to the North American Plate, which consists of the vast majority of the North American Continent. The San Andreas fault, which lies about 35 miles northeast of the City, forms the boundary between the two plates.

While the San Andreas fault accommodates much of the relative motion between the two plates, a significant amount of other fault movement is produced in Southern California. For example, the Transverse Ranges, which include the Santa Monica Mountains, the Verdugo Hills, and the San Gabriel Mountains, formed as a result of localized tectonic compression centered north of Los Angeles. These mountains are currently experiencing uplift, primarily due to the release of strain during earthquakes.

Our understanding of the potential earthquake-related risks to the City have improved greatly in the past two decades. Previously, the San Andreas fault was believed to present the largest earthquake hazard to the City. Although the San Andreas fault is very active and capable of producing great (magnitude 8+) earthquakes every few hundred years, its relatively long distance from the City means that many of the more proximal, nearby faults, though less active and generally capable of smaller magnitude earthquakes, are likely to pose a greater risk to most facilities within the City.

The most important fault may be the Hollywood fault, a reverse fault largely concealed by urbanization that directly underlies the City and has recently been characterized as being active. A state-sponsored fault evaluation report has not yet been conducted to define an Alquist-Priolo (fault rupture) special studies zones along this fault. Other important and potentially hazardous faults include the Raymond, Elysian Park and Compton faults.

2.4 Groundwater Regime

The depth to groundwater varies considerably across the City, and historically has changed significantly because of groundwater pumping and urbanization impacts. The historic high groundwater level in the City is generally represented in a study by Mendenhall (1902). In the 20th century, groundwater levels in the City dropped significantly although groundwater levels appear to have been rising more recently. The most recent

comprehensive evaluation of shallow groundwater elevations in the City was performed by CDMG as part of the Seismic Hazards Mapping Act. In addition, groundwater is typically higher on the north side of the Hollywood fault because the fault acts as a barrier within the alluvial sediments.

3.0 SEISMIC HAZARDS

3.1 Ground Surface Rupture

Ground surface rupture is a serious threat to structures and infrastructure that span active faults. Ground surface rupture has historically occurred in southern California and topographic relief and paleo-earthquake studies in the City suggests that the Hollywood fault has produced ground surface rupture in the past. Within the City, the Hollywood fault is considered capable of producing ground surface rupture during future earthquake events.

Rupture of the Hollywood fault could result in as much as about 1-1/2 feet of lateral offset and 3 feet of thrust offset near the point of nucleation. It is, however, believed that an earthquake on the Hollywood fault would nucleate a few miles underground, and that the rupture would have to propagate to the surface through varying thicknesses of overlying unconsolidated alluvial sediments (overburden). The actual surface rupture that would accompany offset of the Hollywood fault may be substantially less and vary considerably at different locations in the City; some areas may exhibit no offset, whereas other areas may experience offset that approaches the above listed values. Surface rupture of the Hollywood fault would not be anticipated in areas where the fault is overlain by more than about 100 feet of previously unfaulted overburden deposits.

Figure 3 shows the approximate trace of the Hollywood fault projecting south of Sunset Boulevard through the City. The location of the fault is based on information from a variety of sources, including: fault trenching studies, subsurface borings, groundwater barriers, and abrupt breaks in surface topography. The most recent rupture of the Hollywood fault in the West Hollywood area probably occurred 6,000 to 9,000 years ago. Scarps that may have formed at that time have been eroded or buried by more recent sedimentation, and paved or built over by development.

The City has defined two fault precaution zones for future development as shown on Figure 3. The first precaution zone, FP-1, comprises a region approximately 200 feet north and 500 feet south of the hypothesized fault location. A wider precaution zone is prescribed to the south of the fault because of the greater uncertainty in the location and width of the fault zone due to the thick cover of sediment. **New development in the FP-1 zone is required to conduct a fault location investigation, to verify that the main trace or a recently active splay of the fault does not project through critical site structures or facilities.**

The second zone, FP-2, comprises a region approximately 200 feet south of the FP-1 zone. For properties in this zone, the fault rupture hazard is considered to be significant, but considerably less than for properties in the FP-1 zone. Furthermore, geologic study of

the potential for fault rupture may not be practical for properties within zone FP-2 because of the significant thickness of alluvium overlying rock. **New development in the FP-2 zone will require either a fault location investigation, to verify that the main trace or a recently active splay of the fault does not project through critical site structures or facilities, or default provisions for a strengthened foundation system.**

Structures or habitable buildings must be a minimum of 50 feet from the fault, measured between the closest portion of the fault to the closest portion of the foundation for the structure or building. High occupancy buildings must be a minimum of 100 feet (closest distance) from the fault.

Figure 3 also shows the approximate subsurface trace of the Santa Monica fault, located near the southwest portion of the City. The trace indicated on Figure 3 represents the surface projection of the fault, which is believed buried beneath about 500 meters (1,640 feet), of overburden in this area. The Santa Monica fault is not considered a significant ground surface rupture hazard east of Beverly Hills. As a result of the thickness of sediments and lack of surface expression of the fault, no fault precaution zone within the City is recommended at this time for the Santa Monica fault.

3.2 Seismic Source Faults

The City is located in a complex geologic and seismic setting. Numerous major faults occur in the surrounding region that could produce strong ground shaking. Figure 2 shows the location of the City with respect to these faults. On this figure, the traces of faults that project to or near the ground surface are indicated by dashed lines. The shaded polygons bounded by barbed lines indicate the location of "blind" thrust faults, those faults that do not extend to the ground surface.

Table 1 lists many of the faults that appear on Figure 2 in order of increasing direct-line distance from the City. Table 1 also provides basic background information relating to the type, historic activity and relative seismic hazard of each fault as well as the UBC designated fault type (refer to Section 3.3.1). A summary of historic earthquake activity in the southern California area are provided on Table 2.

As indicated on Table 1, less than half of the faults listed have generated earthquakes in the historic period since about 1850. This reflects the fact that geologic processes occur over a long time frame when compared with the time scale of recorded human activity in southern California. It is also notable that most of the historic seismicity listed on Tables 1 and 2 represents relatively small events when compared with the maximum or "upper bound" earthquakes thought possible along given faults.

Table 3 lists the estimated upper bound earthquakes on individual seismic source faults in the southern California area, together with their approximate *average* recurrence intervals (i.e., duration between upper bound events). Deviations from the average return periods are fairly typical, such that the tabulated values are most useful as a relative gauge of the activity of the listed faults.

3.3 Ground Shaking

The relative size of an earthquake is generally characterized by its *magnitude*. The magnitude of an earthquake is a measure of the amount of energy released when a fault ruptures, which is directly related to the size of the fault rupture. The larger the magnitude, generally the larger the ground shaking at a given distance from the fault. Magnitude is assessed through an evaluation of recorded earthquake motions.

The maximum local intensity of ground shaking is a qualitative estimate of the response or damage caused by an earthquake at a given location. Intensity is assessed through an evaluation of the public's perception. A summary of intensity classification is presented in Table 4. An earthquake has only one magnitude (corresponding to the energy released at the source), but a spectrum of intensities and amplitude of ground shaking (generally varying with distance from the source fault).

The severity of ground shaking at any given site is a function of a number of factors. The primary factors include:

- ◆ The magnitude of the earthquake;
- ◆ The distance from the fault plane to the area of concern;
- ◆ The type of bedrock and/or soil materials between the source and the site;
- ◆ The materials upon which the site is situated; and
- ◆ The topographic setting of the site.

The damage experienced at a given location or facility will depend on the severity of ground shaking as well as on the size, shape, age and engineering characteristics of the affected facility.

3.3.1 UBC Design Spectra

Sections 1626 to 1636 of the 1997 Uniform Building Code (UBC) and 1998 California Building Code (CBC) provides for the development of a standardized horizontal response spectrum for seismic design. This spectrum is considered to be a minimum design basis. The hazard level associated with a UBC design generally corresponds to a 10 percent chance of occurrence in 50 years (475-year event). The 1997 UBC and 1998 CBC code provisions include near-fault effects of strong ground shaking for faults less than 15 km from the site.

Selection of a UBC design response spectrum involves identifying the following:

- ◆ All active faults within 15 km
- ◆ The closest Type A and Type B faults
- ◆ Site categorization (soil profile type) as per Section 1636

As summarized in Table 1, the closest faults to the City are classified as Type B faults as per the UBC. The closest Type A fault is the San Andreas fault, which is about 57 km from the closest part of the City. Given that either the Hollywood or Santa Monica faults is within 2 km of any site in the City, the design response spectra is dominated by these two faults. As such, the following parameters are prescribed by the UBC for all sites in the City:

- ♦ Zone 4
- ♦ $N_a = 1.3$ (Table 16A-S of 1997 UBC or 1998 CBC)
- ♦ $N_v = 1.6$ (Table 16A-T of 1997 UBC or 1998 CBC)

The soil profile types within the City include S_B (soft rock) at the base of the mountains through S_D (deep stiff soil) in the majority of the City. Some sites on granitic rock may be classified as S_A (hard rock) sites. The designers must carefully evaluate the soil profile type based on the average blowcounts (SPT N-value), undrained strength of the soil, or shear wave velocity in the upper 100 ft. to select the appropriate UBC spectrum.

As per the UBC, the vertical response spectra for design must be developed from site-specific response analyses given that $N_a = 1.3$ for the City.

For hospitals, other critical facilities, and state-owned or leased property, Section 1637A of the 1998 CBC applies. Other special provisions that may need to be considered when determining design spectra, including soft soil sites or liquefaction sites, are discussed in the Technical Appendix to this chapter.

3.3.2 Peak Ground Acceleration

The peak ground acceleration (PGA) is a quantitative measure of the severity of ground shaking. During an earthquake, the PGA is typically measured in three orthogonal directions, two horizontal (PHGA) and one vertical (PVGA) by a seismometer. The maximum of the two horizontal components is noted as the Maximum Horizontal Acceleration (MHA). PGA is expressed in units of "g," (a fraction or percentage of gravitational acceleration).

Ground acceleration values can be predicted before an earthquake occurs for a given location, using information about nearby seismic source faults, the distance to a source fault, and an attenuation relationship. An attenuation relationship provides an estimate of the ground shaking to be expected at a given location as a function of the magnitude of the earthquake, the distance from the source, and the type of material comprising the substrate (i.e., soil or rock).

Tables 5A and 5B present the estimated mean PHGA values anticipated to result from upper bound ruptures on nearby seismic source faults, for soil sites and rock sites in the City, respectively. Soil sites refer to areas underlain by more than about 20 feet of unconsolidated sediments. As indicated on Figure 1, most of the City falls within this

category. Bedrock lies at or near the surface only along a thin strip situated along the northern edge of the City.

The range of PHGA values given on Table 5A and 5B for each fault represent the maximum and minimum PHGA to be expected at different parts of the City resulting from an upper bound earthquake on the listed fault. The range reflects the varying distance from the source fault to various points in the City. As indicated on the tables, the largest anticipated PHGA values correspond to earthquakes on the Hollywood fault: 0.53-0.57 g for soil sites, and 0.72-0.79 g for rock sites. (Refer to Figure 1 for locations of soil and rock sites.)

The second column in Tables 5A and 5B provides the mean plus one standard deviation PHGA values for upper bound earthquakes on the listed source faults. These values are provided for use in the design of certain critical facilities that must consider a lower-level risk.

In addition to the special provisions for soil conditions mentioned in Section 3.3.1 and described in Technical Appendix, other potential subsurface and geometric factors can modify the ground response at a given site during an earthquake. These factors include:

- ◆ Ridge and Valley Effects
- ◆ Basin Margin Effects
- ◆ Directivity Effects

None of these effects has yet been quantified to the level of incorporation into the UBC. The general effect of each of these variables is reasonably well known, however, as outlined in the Technical Appendix to this chapter.

3.3.3 *Modified Mercalli Intensity Scale*

The Modified Mercalli Intensity (MMI) scale, provided in Table 4, is based on actual observations of earthquake effects at specific points. While an earthquake can have only one magnitude, it can have numerous intensities. The intensity is highest near the epicenter, and it gradually decreases with increasing distance from the epicenter. However, because intensity is so dependent on the ground and structural conditions of a particular area, it may vary considerably at two points that are equidistant from an epicenter. The MMI scale characterizes observations and damage in 12 levels. As indicated on Table 4, the higher the number, the greater the damage. Modified Mercalli Intensities (MMI) corresponding to the listed mean PHGA values are included on Tables 5A and 5B.

3.4 Seismically Induced Hazards

Strong ground shaking can produce ground failure, typically categorized as follows:

- ◆ Liquefaction
- ◆ Lateral spread
- ◆ Soil settlement
- ◆ Landslides

Recently, the State of California passed the Seismic Hazards Mapping Act, which requires that a liquefaction or landslide hazard evaluation be performed for sites within a mapped zone. These zones and the state requirements are presented below. State hazard maps currently do not exist for lateral spread, or earthquake-induced soil settlement hazards.

3.4.1 Liquefaction

Liquefaction is a process by which water-saturated sediment loses strength and may fail during strong seismic ground shaking. Liquefaction susceptibility is strongly affected by the depth to groundwater, the age and composition of sedimentary deposits in an area, and the relative density of cohesionless sediments in the subsurface. Sand is the material having the greatest likelihood to liquefy.

Two criteria – geology and groundwater level – were principally used by the CDMG to define zones of potential liquefaction in West Hollywood. For late Pleistocene-age alluvial deposits, which dominate the currently mapped regions of the City, the criterion for potentially liquefiable soil deposits is that the depth to groundwater is less than 20 feet. For Holocene-age soil deposits (less than 11,000 years of age), which typically extend as alluvial fans from the Santa Monica Mountains, the criterion for liquefaction susceptibility is a depth to groundwater of less than 30 feet.

Areas considered to be susceptible to liquefaction during strong earthquake ground shaking within the City are delimited on Figure 4. The liquefaction zone indicated on Figure 4 was derived from the CDMG Seismic Hazard Zone maps for the Beverly Hills and Hollywood Quadrangles. The state maps were modified to follow property boundaries such that any portion of a property falling within a state-mapped liquefaction zone would cause the entirety of that property to be zoned from the City's perspective.

Under state law, a liquefaction evaluation is required for all new developments except residences with less than 4 dwellings and less than 3 stories. Details of the investigation, analysis and reporting requirements to evaluate the potential for liquefaction and potential mitigation are provided in SP-117.

3.4.2 Lateral Spread

Lateral spread refers to lateral displacement of surficial blocks of sediment as a result of liquefaction in a subsurface layer. Once the process of liquefaction transforms a subsurface layer into a weak, fluidized mass, gravitational forces plus inertial forces

resulting from an earthquake may cause a mass of material to move downslope or toward a cut slope or free face. Given the presence of sloping ground conditions throughout much of the City, lateral spread may prove to be a significant hazard.

Lateral spread should be evaluated in cases where the potential for liquefaction is considered to be moderate or higher.

3.4.3 Seismically Induced Settlement

Loose sands tend to densify when subjected to earthquake shaking. Subsurface densification is manifested at the ground surface in the form of settlement. Both dry and saturated sands can experience seismically-induced settlement. Dry sand densifies rapidly, usually by the end of an earthquake. Saturated sands require minutes or hours to densify after an earthquake. Earthquake-induced settlement can cause distress to structures supported on shallow foundations.

Seismically-induced settlements are a potential hazard for most sites within the City. Therefore, this hazard should be evaluated for all properties, for saturated and unsaturated soil profiles, in the City.

3.4.4 Landslides

Landslides tend to occur in loosely consolidated, wet soil and/or rock on sloping terrain. Landslides are also typically associated with bedrock slopes exhibiting unfavorably oriented planes of weakness such as bedding or joints. Oversteepened slopes (cliffs, stream banks, saturated soil-filled swales, man-made cuts and fills, etc.) are often prone to collapse when shaken by an earthquake. Ground motions produced by earthquakes can cause slopes to fail because the resultant force acting on the slide mass from ground acceleration exceeds the at-rest force restraining the slide. Water is often a contributing factor to landslide movement; thus springs, seeps, and man-introduced water sources (landscape irrigation, leach fields, storm drains, and leaking water lines) can influence landslide creation, movement, and extent of damage.

Areas considered to be susceptible to landslides during strong earthquake ground shaking within the City are delimited on Figure 4. The landslide zone indicated on Figure 4 was derived from the CDMG Seismic Hazard Zone maps for the Beverly Hills and Hollywood Quadrangles. The state maps were modified to follow property boundaries such that any portion of a property falling within a state-mapped landslide zone would cause the entirety of that property to be zoned from the City's perspective.

The criteria used by CDMG to identify a seismically induced landslide hazard are:

- ◆ Areas with historic instability, whether seismically induced or not; and
- ◆ Areas where geologic or geotechnical data analyses, including evaluation of terrain data, strength data, seismic accelerations and slope stability analysis, indicate susceptibility to seismically induced landsliding.

Prior to the 1994 Northridge earthquake, no earthquake-triggered landslides had been identified in the Hollywood quadrangle. The 1994 Northridge earthquake caused a number of relatively small, shallow slope failures outside the City within the Hollywood Quadrangle with a cumulative area affected by this earthquake of about 0.5 acres.

Under the Seismic Hazards Mapping Act, an earthquake-induced landslide evaluation is required for all new developments except residences with less than 4 dwellings and less than 3 stories. Details of the investigation, analysis and reporting requirements to evaluate the potential for liquefaction and potential mitigation are provided in SP-117.

3.4.5 *Tsunamis*

Tsunamis are long-period waves in the ocean produced by large, sudden submarine disturbances, particularly earthquakes. Tsunamis can be a significant hazard in some coastline communities. Japan and other islands in the Pacific Ocean historically have been affected the most by this hazard. Historically, southern California has experienced tsunamis resulting from two large distant events (the 1960 Chile and 1964 Alaska earthquakes) and two close, smaller events (1812 Santa Barbara and 1927 Point Arguello earthquakes). Most of the damage was confined to ports, harbors, and within a few hundred feet of the coastline.

Given the closest distance to the ocean (about 7½ miles) and the significant elevation difference between the City and sea level (minimum of 160 ft), the tsunami hazard in the City is considered to be very remote.

3.4.6 *Seiches*

Seiches are "sloshing" waves that are formed from excitation of a confined body of water. Given the absence of large, open water reservoirs within the City and given that reservoirs in the mountains are not upslope of the City, the seiche hazard is considered to be very remote.

4.0 NON-SEISMIC GEOLOGIC HAZARDS

4.1 Mudslides

Mudslide or mudflows refer to shallow slope failures resulting from excessive rain that saturates the ground and flows downslope. Mudslides are common in the Santa Monica Mountains.

Mudslides are considered to be a significant hazard to properties at the base of undeveloped or unimproved slopes in the Santa Monica Mountains. Within the City, this hazard, then, is confined to only a few properties, all located north of Sunset Boulevard.

4.2 Landslides

Landslides refer to slope failures in natural rock or soil slopes (Refer to Section 3.4.4). Landslides typically occur where a plane of weakness exists in the earth materials and elevated groundwater conditions exist.

Previous mapping in the L.A. County Seismic Safety Element suggests that the slopes at, or potentially affecting, the northern margin of the City are relatively stable.

4.3 Expansive Soil and Rock

Expansive soil and rock are characterized by having a potential for shrinking and swelling under changing moisture conditions. These materials typically affect foundations, slabs, and exterior improvements to properties.

Expansive materials may exist in various areas of the City. Current provisions in building codes are considered to be suitable for design at sites with expansive soils. Therefore, designs should include proper characterization of the hazard through soils investigations and follow building codes.

4.4 Collapsible Soils

Collapsible soil is characterized by having a potential for significant shrinking upon wetting. These materials typically affect foundations, slabs, and exterior improvements to properties.

Collapsible soils are known to exist within the City. However, the severity of this hazard in the City is only considered to be low to moderate. Current provisions in building codes are considered to be suitable for design at sites with collapsible expansive soils. Therefore, designs should include proper characterization of the hazard through soils investigations and follow building codes. In some cases, the collapsible soil may need to be overexcavated and recompacted wet of optimum moisture content to mitigate the collapse hazard.

4.5 Ground Subsidence

Ground subsidence is typically associated with regional changes in ground surface elevation associated with seismic warping, lowering of groundwater through pumping, and removal of oil and natural gas through pumping.

Seismic warping or uplift is occurring beneath the City based on global geodetic data. However, these movements are distributed over large areas and, as a consequence, rarely produce damage.

Given the recent trend for controlled groundwater pumping and the consequent rise in groundwater, the hazard for ground subsidence from groundwater lowering is expected to be very low.

The nearest oil fields to the City are the Salt Lake and Beverly Hills/Cheviot fields. Only marginal activity currently exists within the Salt Lake field, located along the southern margin of the City along Beverly Boulevard. Water injection and flooding operations are believed to have largely mitigated subsidence hazard in the City.

5.0 FLOOD AND INUNDATION

The Los Angeles Basin, of which West Hollywood is a part, has historically experienced flooding during major winter storm events. Fortunately, the City is situated on relatively high ground and does not have a major waterway subject to flood hazards. However, the City is situated at the base of the mountains with steep narrow canyons that drain into the City.

The latest (1987) FEMA Flood Insurance Rate Map (FIRM), replicated on Figure 5, indicates that a small portion of the City is within a 100-year flood plain. Following planned construction of a regional storm drain relief system, LA County is planning to submit necessary paperwork to reclassify the 100-year flood plain (Zone AO) to a Zone X, similar to the surrounding area.

No major dams and open reservoirs exist in the mountains upstream of the City. However, Hollywood Reservoir exists to the east of the City and Franklin Dam exists to the west of the City. A dam break at either of these locations would likely inundate a portion of the City (refer to Plate 6 of L.A. County Safety Element). For Hollywood Reservoir, the inundation area on the east side of the City might extend as far west as Gardner Street.

A few steel reservoir tanks exist in the mountains upslope of the City. Failure of one of these tanks could potentially adversely impact property downslope. For example, a failure of the tank at Greystone Park would inundate a portion of the southwest corner of the City (refer to Plate 6 of L.A. County Safety Element).

6.0 URBAN FIRES

Urban fires are a constant threat in the City, given the seismic hazards of fault rupture, strong ground shaking, and liquefaction. In the United States, fires following earthquakes have caused the largest losses associated with earthquakes.

Urban fires following earthquakes are driven by two key features: 1) the earthquake is likely to ignite multiple, nearly simultaneous fires; and 2) the earthquake is likely to damage and disrupt fire suppression by severing water pipelines and delaying the arrival of adequate fire-fighting equipment and personnel.

Fire growth is related to building density, types building construction, the presence and amount of flammable materials, wind speed and direction, width of fire breaks, water supply, time of fire department arrival, and available fire fighting resources. Fortunately in

this regard, the Salt Lake oil field is isolated along Beverly Boulevard at the southwest margin of the City (refer to Plate 7 of Los Angeles County Safety Element). There are no major petrochemical or industrial plants.

In terms of transmission lines, the primary line posing a hazard is a natural gas distribution and transmission line that runs up La Brea Avenue, at the far east margin of the City. This line angles up from La Brea Avenue toward Laurel Canyon (refer to Plate 7 of Los Angeles County Safety Element). Severing of this line as a consequence of fault rupture, liquefaction, or ground shaking would present a serious fire hazard.

7.0 BUILDING INVENTORY

The State's General Plan Guidelines focus exclusively on unreinforced masonry buildings, and the abatement of hazards from them. The City has adopted an ordinance requiring retrofitting of unreinforced masonry buildings, and all known URM have been retrofitted.

Other types of buildings which may pose a hazard in the event of an earthquake include soft-story buildings (where one or more floors are supported by posts, as in buildings with 'tuck-under' parking); concrete tilt-up buildings; non-ductile reinforced concrete and non-ductile precast concrete buildings; and some steel frame buildings.

8.0 EMERGENCY RESPONSE

Effective implementation of seismic policies will help reduce the magnitude of damage in an earthquake, but a variety of damage should still be anticipated. Effective response to a disaster or to a warning of disaster is essential to life saving and the reduction of subsequent property damage and social dislocation.

The emergency response capability within the city is geared primarily to non-disaster incidents, and police and fire capabilities will be overwhelmed in a large disaster.

In a major earthquake, mutual aid sources in adjacent jurisdictions are likely to be fully committed to their own needs, and there may be substantial delays in the request and transport of assistance from more distant locations. Access to and egress from the city is likely to be inhibited by earthquake damage and related congestion and accidents.

Effective disaster preparedness will require the concerted efforts of city agencies, residents and the business community. Not only must effective plans and procedures be in effect, but those plans should be tested and improved through frequent disaster exercises.

9.0 PLANNING FOR POST-DISASTER RECOVERY

The city's ultimate post-earthquake survival will depend not only on the effectiveness of hazard mitigation and disaster response programs, but also on how quickly and how well the city rebuilt after a major earthquake. Without pre-planning, effective programs and options for rapid reconstruction will not be reasonable in the immediate aftermath of an earthquake.

A damaging earthquake presents both problems and opportunities in urban land-use management. For example, if there are larger areas of substantial damage, there may be need for short-term redevelopment. This would also provide opportunities for upgrading of the city through such measures as revised street and traffic patterns, parking, architectural and landscape design, and general land-use compatibility. It would also provide an opportunity to mitigate specific earthquake hazards discovered in the earthquake.

GOALS, OBJECTIVES, AND POLICIES

The following presents the goals, objectives, and policies for seismic safety in the City of West Hollywood. Implementing programs are contained in the following subsection. At the end of each policy is listed a capital "I" and number parentheses which refers to the pertinent implementing program.

Goals

14A - Substantially reduce the level of death, injury, property damage, economic and social dislocation and disruption of vital services that would result from earthquake damage.

14B - Ensure the availability and effective response of emergency services following an earthquake.

14C - Prepare the city for effective response to, and rapid, beneficial recovery from, an earthquake.

A. ISSUE ONE: CRITICAL, SENSITIVE AND HIGH-OCCUPANCY FACILITIES

Objective

14.1 - Ensure the continued functioning of essential facilities following a disaster; prevent loss of life from the failure of critical and sensitive facilities in an earthquake; and help prevent major problems for post-disaster response, such as difficult or hazardous evacuations or rescue, large numbers of injuries, and major clean-up or decontamination of hazardous materials.

Policies

14.1.1 - Require that earthquake survival and efficient post-disaster functioning be a primary concern in the siting, design and construction standards for essential facilities (I14.1, I14.2, I14.4, I14.5, and I14.8).

14.1.2 - Prohibit the location of new Critical Facilities in proximity to active or potentially active faults. For this purpose, the fault precaution zone shall constitute proximity until and unless a substantial body of information is available for definitive location of fault traces (I14.1, I14.2, and I14.8).

14.1.3 - Prohibit the location of new Sensitive and High-Occupancy facilities within 100 feet of an active or potentially active fault, or require compensating design characteristics where fault identification is not feasible. Sensitive and High-Occupancy facilities may be located less than 100 feet from an active or potentially active fault, if it can be shown that a reduced setback will not threaten public safety. (I14.1, I14.2 and I14.8).

14.1.4 – Encourage Critical, Sensitive, and High-Occupancy Facilities in areas below a dam to develop procedures for effective evacuation from the area and/or continued functioning. (I14.5 and I14.6).

14.1.5 - Avoid the placement of Critical and Sensitive Facilities in or near potential liquefaction areas if continuous road access or uninterrupted utility service is needed following an earthquake (I14.1, I14.2, and I14.8).

14.1.6 - Require that existing Critical and Sensitive Facilities with significant seismic vulnerabilities be upgraded, relocated or phased out as appropriate (I14.10 and I14.12).

14.1.7 - Incorporate planning for potential incidents affecting Critical, Sensitive and High-Occupancy Facilities into the City's contingency plans for disaster response and recovery (I14.5, I14.7, and I14.10 through I14.12).

14.1.8 - Require all Critical, Sensitive, and High-Occupancy Facilities located in areas of potential hazards to maintain emergency response plans, with contingencies for all appropriate hazards (I14.5, I14.7, and I14.10 through I14.12).

B. ISSUE TWO: HAZARDOUS BUILDINGS

Objective

14.2 - Prevent the loss of life, serious injuries, and major social and economic disruption caused by the collapse of or severe damage to vulnerable buildings in an earthquake.

Policies

14.2.1 - Adopt a program for the orderly and effective upgrading of seismically hazardous buildings in the City of West Hollywood for the protection of health and safety. Compliance with SB547 shall include the enactment of an effective program for seismic upgrading of unreinforced masonry buildings within the city (I14.10, I14.13, I14.18, and I14.19).

14.2.2 - Develop procedures for seismic review of other potentially, hazardous buildings at appropriate points in the buildings' histories (I14.10, I14.17, I14.18, and I14.20).

14.2.3 - Promote seismic upgrading of older residential and commercial structures as part of community redevelopment and housing rehabilitation programs (I14.14, I14.15 and I14.17 through I14.20).

C. ISSUE THREE: STRONG GROUND MOTION

Objective:

14.3 - Protect health and life safety from the adverse effects of strong ground motion, through the implementation of effective standards for seismic design of structures in the City of West Hollywood, consistent with the state-of-the-art, and reduce the level of

potential property damage from strong ground motion, thereby facilitating rapid physical and economic recovery following an earthquake.

Policy:

14.3.1 - Adopt and maintain high standards for seismic performance of buildings, through prompt adoption and careful enforcement of the best available standards for seismic design (I14.1, I14.3, I14.4 and I14.22 through I14.27).

D. ISSUE FOUR: FAULT RUPTURE

Objective:

14.4 - Protect life safety, substantially reduce the damage from fault rupture, and help ensure orderly evacuation of building occupants following an earthquake.

Policies:

14.4.1 – Relate land use regulations regarding potentially active faults to the importance or criticality of the use, size of the facility, and relative ease of evacuation of occupants if the building is damaged by fault rupture (I14.1, I14.2, I14.4, I14.5, and I14.6).

14.4.2 - Promote the collection of relevant data on fault location and history of fault displacement, as a basis for future refinement of fault zone policies (I14.8 and I14.28).

E. ISSUE FIVE: LIQUEFACTION

Objective:

14.5 - Protect life safety and essential lifelines; reduce the potential for property damage from liquefaction; and promote the collection of more complete information on liquefaction susceptibility throughout the City.

Policies:

14.5.1 - Determine the liquefaction potential at a site prior to development, and require that specific measures be taken, as necessary, to prevent or reduce damage in an earthquake (I14.2 and I14.5).

14.5.2 - Relate land use regulations regarding potential liquefaction zones to the importance or criticality of the use, size of the facility, and relative ease of evacuation of

occupants if the building is damaged by ground failure due to liquefaction (I14.2 and I14.5).

14.5.3 - Promote the collection of relevant data on groundwater levels and liquefaction susceptibility, as a basis for future refinement of liquefaction policies or procedures (I14.8).

14.5.4 - Include potential damage to essential lifelines in liquefaction mitigation programs (I14.10 through I14.12 and I14.29 through I14.37).

F. ISSUE SIX: DAM FAILURE EVACUATION AREAS

Objective:

14.6 - Protect Critical Facilities from damage, loss of function or inaccessibility in the event of damage to the dam; protect sensitive facilities from detrimental consequences of inundation; and help ensure the rapid and orderly evacuation of populations in the potential inundation area, if necessary.

Policies:

14.6.1 – Encourage new and existing Critical, Sensitive and High-Occupancy facilities within the potential inundation area below a dam to develop plans for evacuation and shutdown procedures or continued operation during utility failure (I14.6, I14.7, I14.11 and I14.29 through I14.32).

14.6.2 - Require that zoning, street planning, and other land use decisions be consistent with the need for efficient and orderly evacuation capabilities for the potential inundation area (I14.29, I14.38, I14.40, I14.41 and I14.45).

14.6.3 - Ensure that emergency preparedness plans and procedures provide for the efficient and orderly notification and evacuation of potential inundation areas below Mulholland dam (I14.6, I14.7, I14.11 and I14.29 through I14.32).

G. ISSUE SEVEN: EMERGENCY PREPAREDNESS

14.7 - Provide effective response in a disaster, for life-saving and the curtailment of property damage and social dislocation; enhance emergency preparedness through community education and self-help programs; and prevent serious damage and injuries through effective hazard mitigation.

Objective:

14.7 - Provide effective response in a disaster, for life-saving and the curtailment of property damage and social dislocation; enhance emergency preparedness through

community education and self-help programs; and prevent serious damage and injuries through effective hazard mitigation.

Policies:

14.7.1 - Ensure that emergency preparedness is the mutual responsibility of City agencies, city residents and the business community (I14.29 through I14.37).

14.7.2 - Incorporate three emphases to the City's emergency preparedness program: hazard mitigation, disaster response and self-sufficiency/mutual support of residents, business and industry (all programs).

14.7.3 - Exercise and upgrade the City's disaster response plans at least annually, conduct periodic tests of their practicality and effectiveness, train residents and businesses in disaster response and business shutdown and evacuation procedures. (I14.29, I14.32, I14.34, I14.36, and I14.37).

14.7.4 - Prepare and disseminate to residents and business persons information regarding seismic risks affecting the City of West Hollywood, measures to protect life and property before and, during an earthquake, and emergency procedures to follow after an earthquake (I14.34, I14.36 and I14.37).

H. ISSUE EIGHT-. POST-DISASTER RECONSTRUCTION

Objective

14.8 - Plan for and facilitate the rapid and effective recovery of the city following an earthquake; prevent the recurrence of specific problems and hazards encountered during an earthquake; and plan for alternative sources of financing of damage and reconstruction.

Policies:

14.8.1 - Develop programs, options, and procedures to promote the rapid reconstruction of the city following an earthquake, and to facilitate a specific upgrading of the community environment, as opportunities allow (I14.38 through I14.45).

14.8.2 - Establish the mitigation of earthquake hazards as a high priority for City programs, both before and after an earthquake (I14.1 through I14.5, I14.8 through I14.20, I14.22 through I14.27, I14.29 through I14.31 and I14.33 through I14.46).

IMPLEMENTATION PROGRAMS

The following lists the programs to implement the seismic safety policies contained in the pre-ceding sub-section of the Plan. The capital "I" and number preceding each program are referenced by the policies which it implements.

Zoning and Building Codes

I14.1 - The building and zoning codes shall be amended to incorporate specific standards for siting, seismic design, and review of Critical, Sensitive and High-Occupancy Facilities.

I14.2 - Where appropriate, detailed site studies for ground shaking characteristics, liquefaction potential and fault rupture potential shall be required as background to the development approval process for Critical, Sensitive, and High-Occupancy Facilities.

I14.3 - Zoning regulations shall prohibit new Critical Facilities from being located in Fault Precaution Zone 1 of a potentially active fault. No building designed for human occupancy shall be constructed within fifty feet of an active fault.

I14.4 - Within the Fault Precaution Zone, Sensitive and High-Occupancy Facilities shall observe a minimum 100-foot setback from an active or potentially active fault. High occupancy facilities may be permitted up to 50 feet from an active or potentially active fault, if a fault rupture study determines that the reduced setback would not harm the public health, safety and welfare. Fault rupture studies shall be carried out in a manner approved by the City. Where off-site information is unavailable due to existing development, compensating design shall be incorporated to reduce the potential for foundation and structural damage arising from secondary ground displacements in the fault zone.

I14.5 - Standard conditions of approval for new Critical and Sensitive Facilities proposed in or near potential liquefaction areas should include review of emergency response plans by the Public Safety Division for such concerns as: blockage of road access and interruption of essential utility service as a result of liquefaction in the area.

I14.6 - The Zoning Ordinance shall be amended for the dam failure inundation area as necessary to require review by the Public Safety Division for:

- a) The limited expansion of Critical Facilities. New construction of new Critical Facilities in a potential dam failure inundation area shall be prohibited;
- b) Sensitive Facilities including: nursing homes, senior citizens housing and other low-mobility uses, where rapid evacuation capabilities may be inhibited; and commercial and industrial facilities housing hazardous materials, or potentially hazardous operations requiring safe shutdown procedures; and
- c) High-Occupancy Facilities and all assembly occupancies of 100 or more occupants.

I14.7 - The Public Safety Division shall work in conjunction with the West Hollywood Sheriff's Station to ensure that rapid notification plans following a dam failure are included in the City's Emergency Response Plans.

114.8 – The Building and Safety Division shall keep abreast of any groundwater, liquefaction susceptibility, and fault zone mapping or other technical review conducted by the State Division of Mines and Geology.

114.9 – The City shall continue to foster public participation in and education of hazard mitigation and disaster recovery programs.

Existing Hazards: Critical Facilities

114.10 - Existing critical, sensitive and high-occupancy facilities shall be reviewed for any significant siting, design or construction problems that would make them vulnerable in an earthquake. The findings shall be incorporated into emergency operations plans as well as addressed in longer-term programs of facilities upgrading or relocation.

114.11 - All critical, sensitive and high-occupancy uses in the dam inundation area should develop and maintain plans for efficient shutdown of their operations and evacuation of their facilities in the event of damage to the dam.

114.12 - Essential facilities within the city shall be surveyed for seismic hazards and programs shall be developed as appropriate for correction of any significant problems that could jeopardize public health and safety or inhibit effective emergency response.

Hazardous Buildings

114.13 - Data on the current inventory of unreinforced masonry buildings shall be maintained and updated, including all information required under SB547.

114.14 - Continue to enforce Ordinance No. 254 , requiring upgrading of unreinforced masonry buildings.

114.15 - Strategies and program options should be developed for preservation or replacement of the low- and moderate-income housing currently located in hazardous buildings. Possible strategies include, among others: community redevelopment programs; low-interest loans for seismic rehabilitation of residential buildings; preservation of nonconforming zoning rights for in-kind replacement of residential buildings; and relocation assistance for any displaced occupants.

114.16 - Appropriate means of economic relief for commercial buildings that fall under the hazardous buildings program, should also be considered, such as: preservation of non-conforming zoning rights for in-kind replacement of commercial buildings, combined with the establishment of parking districts for relief of parking problems that would be perpetuated by the waiver of current parking requirements; and community redevelopment programs for the coordinated upgrading of seismic, economic, and general design characteristics of affected commercial areas.

114.17 - The City shall maintain a cognizance of other types of potentially hazardous buildings and develop programs for the reduction of seismic hazards. For example,

concrete tilt-up buildings built before enactment of the current seismic codes should be required to meet basic seismic standards when significant alteration or repair is proposed.

114.18 - Special structural reviews shall also be conducted on any multi-story or concrete buildings receiving significant damage in an earthquake, prior to their repair or demolition. Structural reviews prior to repair would be the responsibility of the owner; arrangements can be made with the Structural Engineers Association of California or the Earthquake Engineering Research Institute for support in the pre-demolition review of severely damaged buildings.

114.19 - Include the upgrading of unreinforced masonry buildings as a contributing objective of any redevelopment project.

114.20 - Incorporate financial incentives and guidance for the seismic upgrading of older dwellings in any community development or housing rehabilitation program for older neighborhoods, including the possible use of low interest or tax-exempt loans.

114.21 - Groundwater problems related to any old, improperly-abandoned water wells and to the old, abandoned drainage system shall be mitigated wherever possible, by proper sealing and abandonment procedures.

Building Codes and Review Procedures

114.22 - Future revisions to the seismic building code shall also receive early review and incorporation, as appropriate, into the City Building Code.

114.23 - Effective review of seismic design for proposed buildings shall be conducted by on-staff structural engineers or through third-party review by qualified engineers responsible to the City.

114.24 - All geologic and soils reports submitted to the Community Development Department in the enforcement of general plan policies shall be reviewed for their adequacy and completeness by an experienced geologist or structural engineer retained by the City.

114.25 - A central repository shall be established in the Community Development Department, for the collection and compilation of geologic and soils engineering information related to faults and fault zone studies, groundwater levels, soils characteristics, susceptibility to landslides and liquefaction, and other data as appropriate. The range of opportunities for collection of new liquefaction and fault-related data shall be identified, and a long-term program developed for geologic inspection of all significant excavations in the fault zones. The cooperation of other agencies should be sought, to help identify additional opportunities for data collection. This information shall be used to increase the knowledge and insights of City reviewers and applicants alike, in support of hazard mitigation.

114.26 - Within fault precaution zones, pre-construction fault studies shall be required prior to construction of new buildings or of significant additions, to help determine the presence and nature of any fault, and to help in the adaptation of the building design to reduce or avoid potential damage.

114.27 - When other provisions of this Element indicate geotechnical investigations, field excavations shall be inspected by a geologist or soils engineer.

114.28 - The Zoning and Building Codes shall continue to require liquefaction and other geotechnical studies in all areas considered by the State Division of Mines and Geology to have the potential for permanent ground displacement.

Emergency Preparedness

114.29 - Appropriate disaster response and earthquake response plans shall be maintained and updated on a regular basis.

114.30 - Because of the significant number of hazardous buildings in West Hollywood, disaster response plans shall include adequate capabilities for involvement of local residents and businesses, heavy search and rescue, major medical response, interim morgue, emergency shelter, traffic and utility impacts, debris removal and disposal, as well as hazardous materials response for any chemicals stored or used in or adjacent to the hazardous buildings.

114.31 - Disaster response plans shall also include procedures for traffic control, emergency evacuations, and security of damaged areas.

114.32 - Effective procedures and contingencies for notification and evacuation of the designated inundation area shall be incorporated into the City's emergency preparedness plans and tested in disaster exercises.

114.33 - The City and its contract agencies shall maintain effective mutual aid agreements for fire, police, medical response, public works, mass care, and heavy rescue.

114.34 - Earthquake response exercises shall be conducted at least once a year. Exercises shall be designed to test and upgrade various disaster response plans and involve local residents, business persons, and other volunteers. Disaster planning scenarios and emergency response plans shall include contingencies for:

- a. possible ruptures on both faults, either separately or simultaneously;
- b. collapse of 50 buildings or more, including some high-rise and mid-rise structures, some essential facilities, and numerous unreinforced masonry buildings;
- c. sporadic ground rupture due to liquefaction, with major disruption of streets and utilities in some areas, and serious damage to homes and businesses;
- d. rapid evacuation of the potential inundation area below Mulholland Dam; and
- e. many aftershocks, continuing for several weeks or months.

114.35 - Earthquake prediction response plans should be developed, including procedures for protecting occupants of hazardous buildings, appropriate warning announcements and public education procedures, and other short-term preparations.

114.36 - A program of public education, and preparedness shall be a major, continuing component of the emergency preparedness program. It should include, at a minimum:

- a. the existence and approximate locations of local faults, liquefaction susceptibility areas, and the dam evacuation area;
- b. the potential for strong ground shaking in the area, and means of strengthening buildings and protecting furnishings, equipment and other building contents from damage;
- c. the need for businesses and residents to be self-sufficient for several days following an earthquake, including food, water, medical assistance, and limited fire-fighting.

114.37 - The cooperation of the business community should be enlisted for public education and mutual assistance. Businesses should develop their own disaster response plans and have provisions for food, water, first aid and shelter of employees who may not be able to return home for several days following a major earthquake.

Planning for Post-Disaster Recovery

114.38 - A standing committee for disaster recovery shall be established prior to any disaster, to provide contingency planning for the rapid and effective reconstruction of the City of West Hollywood following a disaster. The committee shall include representatives of the City Council, Planning, Public Works, Economic Development and Building and Safety policy functions, as well as liaison to the local utilities and any state and federal redevelopment, housing and/or reconstruction programs, and other functions as necessary. The committee shall have review authority for all emergency activities in the city.

114.39 - The committee shall develop effective procedures for post-disaster damage assessment as appropriate for:

- a. obtaining State and Federal disaster assistance;
- b. obtaining the maximum allowable reimbursement for repair and reconstruction of public facilities;
- c. determining the location and nature of damage as an immediate basis for specific recovery planning.

114.40 - The committee shall be charged with the overall review of damage patterns, and development of specific plans for post-disaster reconstruction, including programs for effective recovery of lifelines, housing and the commercial viability of the community.

114.41 - The committee shall propose any changes in land use, lifelines, circulation, and architectural/ landscape design within a reasonably short time after the disaster, to allow their early incorporation into post-disaster reconstruction.

114.42 - The committee shall develop and institute procedures for rapid determination of locations where significant damage is caused by inherent geologic or structural problems that must be corrected to prevent recurring damage (high hazard areas).

114.43 - Policies and procedures shall be instituted to facilitate the rapid repair and reconstruction of all facilities not designated as high hazard areas.

114.44 - Procedures shall be developed for obtaining appropriate professional review of the high hazard areas, along with specific recommendations for hazard mitigation.

114.45 - Guidelines shall be developed by the Disaster Recovery Committee, for the exercise of emergency authorities for such purposes as:

- a. rapid designation of redevelopment areas;
- b. revision of land use, circulation and parking requirements, and institution of other programs for improving the community environment;
- c. adaptation and institution of special programs for disaster recovery;
- d. funding of disaster recovery measures;
- e. moratoria on reconstruction in any high-hazard areas where damage could be repeated in aftershocks or in future earthquakes;
- f. up-grading of the building code
- g. establishment of Geologic Hazard Abatement Districts, as appropriate; and
- h. designation of sites for temporary housing (e.g., travel trailers and pre-fab construction) of households made homeless in the disaster, in cooperation with the Disaster Housing Program of the Federal Emergency Management Agency.

114.46 - Solicit state and federal funds to implement the City's seismic safety programs as such revenues are available.

TABLE 1
CHARACTERIZATION OF FAULTS CONSIDERED SIGNIFICANT TO
SEISMIC SHAKING HAZARD

Fault/Fault Segment Name	Fault Style ⁽¹⁾	Approximate Closest Distance to City ⁽²⁾ (km)	Notable Historic Earthquake Surface Wave Magnitude, Ms (yr.)	Estimated "Upper Bound" Moment Magnitude, Mw ⁽⁴⁾	1997 UBC Fault Type
Santa Monica System					
Hollywood	OBL	0	—	6.4	B
Santa Monica	OBL	0.5	5 (1979, 1989)	6.6	B
Blind Thrust	TH	15	—	7.1	
Malibu Coast	OBL	23	—	6.7	B
Newport-Inglewood System					
Inglewood Segment	RL	5.0	4.9 (1920)	6.9	B
Peralta Hills System					
Las Cienegas	R	8.6	—	6.7	
Elysian Park Thrust					
Los Angeles Segment	TH	11	—	6.7	
Compton Thrust					
Baldwin Hills Segment	TH	12	—	6.7	
Verdugo-Eagle Rock System					
	R	14	—	6.7	B
Whittier-Elsinore System					
West LA Blind Thrust	TH	14	—	6.5	B
East LA Blind Thrust	TH	22	—	6.5	B
Puente Hills Thrust					
Los Angeles Segment	TH	15	—	6.5	
Raymond	OBL	15	~6 (1855)	6.5	B
Northridge Hills	R	18	—	6.6	
Sierra Madre System					
Dunsmore	R	20	—	7.4	
San Fernando	R	21	6.4 (1971)	6.7	B
Mission Hills	R	23	—	6.2	
Sierra Madre	R	27	5.8 (1991)	7.4	
Oak Ridge System					
Northridge Blind Thrust	TH	25	6.7 (1994)	6.9	B
Palos Verdes-Coronado Bank System					
Santa Monica Bay to LA Harbor	OBL	25	3.9 (1972)	7.1	B
San Gabriel (Western Part)	RL	26	—	7.0	B
Anacapa-Dume	OBL	33	5.0 (1979)	7.3	
San Andreas System					
Mojave Segment	RL	57	~8 (1857) ⁽³⁾	7.1	A

- Notes:
- (1) Fault Styles: RL = Right Lateral; R = Reverse; TH = Thrust; OBL = Oblique
 - (2) Closest distance as defined by Abrahamson and Silva (1997)
 - (3) Multi-segment rupture that included the Mojave segment.
 - (4) As reported by Dolan et al. (1995), CDMG (1996), USGS (1996), Rubin et al. (1998) and Shaw and Shearer (1999). Elsewhere based on relationship of Wells and Coppersmith (1994).

TABLE 2
SUMMARY OF HISTORIC EARTHQUAKES WITH MAGNITUDES
GREATER THAN 5.0 AND EPICENTRAL DISTANCES OF LESS THAN 100 KM

Date	Earthquake (Fault Name where Known)	Latitude (°N)	Longitude (°W)	Magnitude	Epicentral Distance (km)
Jan. 17, 1994	Northridge (Northridge Blind Thrust)	34.21	118.54	6.7	20
July 11, 1855	Pasadena area (Raymond?)	34.1	118.1	~6	~21
Oct. 1, 1987	Whittier-Narrows (Puente Hills Blind Thrust)	34.06	118.08	5.9	27
Aug. 31, 1930	Santa Monica Bay	33.95	118.63	5.2	27
Jan. 19, 1989	Malibu	33.92	118.63	5.2	29
Jan. 1, 1979	Malibu	33.94	118.68	5.1	32
Nov. 14, 1941	San Pedro area (Newport-Inglewood?)	33.78	118.25	5.4	35
Feb. 9, 1971	San Fernando (San Fernando)	34.41	118.40	6.6	36
June 28, 1991	Sierra Madre (Sierra Madre)	34.26	118.00	5.8	39
Feb. 21, 1973	Point Mugu (Anacapa)	34.06	119.04	5.9	60
Feb. 28, 1990	Upland (San Jose)	34.14	117.7	5.4	62
Sept. 12, 1970	Lytle Creek	34.27	117.54	5.4	79
July 22, 1899	Cajon Pass	34.25	117.5	~5.7	~80
Sept. 4, 1981	North of Sta. Barbara Is.	33.66	119.09	5.9	82
Oct. 23, 1916	Tejon Pass	34.90	118.90	6.0	89
May 15, 1910	Lake Elsinore area (Elsinore)	33.7	117.4	6.0	99

TABLE 3
RECURRENCE INTERVALS OF MAXIMUM CREDIBLE EARTHQUAKES
IN THE SOUTHERN CALIFORNIA AREA

Fault/Fault Segment Name	Approximate Closest Distance to City ⁽¹⁾ (km)	Estimated "Upper Bound" Moment Magnitude, Mw ⁽²⁾	Estimated Recurrence Interval (years) ⁽³⁾
Santa Monica System			
Hollywood	0	6.4	1005 - 1505
Santa Monica	0.5	6.6	820
Blind Thrust	15	7.1	740
Malibu Coast	23	6.7	2910
Newport-Inglewood System			
Inglewood Segment	5.0	6.9	1010
Peralta Hills System			
Las Cienegas	8.6	6.7	1000
Elysian Park Thrust			
Los Angeles Segment	11	6.7	550
Compton Thrust			
Baldwin Hills Segment	12	6.7	680
Verdugo-Eagle Rock System			
	14	6.7	1610
Whittier-Elsinore System			
West LA Blind Thrust	14	6.5	785
East LA Blind Thrust	22	6.5	710
Puente Hills Thrust			
Los Angeles Segment	15	6.5	250 - 1000
Raymond	15	6.5	1540
Northridge Hills	18	6.6	1610
Sierra Madre System			
Dunsmore	20	7.4	1000
San Fernando	21	6.7	8750
Mission Hills	23	6.2	1400
Sierra Madre	27	7.4	8750
Oak Ridge System			
Northridge Blind Thrust	25	6.9	820
Palos Verdes-Coronado Bank System			
Santa Monica Bay to LA Harbor	25	7.1	650
San Gabriel (Western Part)	26	7.0	1270
Anacapa-Dume	33	7.3	530
San Andreas System			
Mojave Segment	57	7.1	550

- Notes:
- (1) Closest distance as defined by Abrahamson and Silva (1997).
 - (2) As reported by Dolan et al. (1995), CDMG (1996), USGS (1996), Rubin et al. (1998) and Shaw and Shearer (1999). Elsewhere based on relationship of Wells and Coppersmith (1994).
 - (3) As reported by Dolan et al. (1995), CDMG (1996), USGS (1996), Rubin et al. (1998) and Shaw and Shearer (1999).

TABLE 4A
RELATIVE IMPACT OF SELECTED EARTHQUAKES
ON THE CITY
(SOIL SITES)

Fault/Fault Segment Name	Estimated Mean PHGA (g) in West Hollywood ⁽¹⁾	Mean + 1 Standard Deviation (g)	Modified Mercalli Intensity (MMI) for Mean PHGA ⁽²⁾
Santa Monica System			
Hollywood	0.53-0.57	0.87-0.93	IX
Santa Monica	0.53-0.56	0.85-0.91	IX
Blind Thrust	0.33-0.34	0.52-0.54	VIII
Newport-Inglewood System			
Inglewood Segment	0.35-0.43	0.55-0.67	VIII
Elysian Park Thrust			
Los Angeles Segment	0.31-0.36	0.49-0.58	VIII
Compton Thrust			
Baldwin Hills Segment	0.29-0.34	0.47-0.55	VIII
Verdugo-Eagle Rock System			
	0.21-0.29	0.34-0.46	VII-VIII
Puente Hills Thrust			
Los Angeles Segment	0.20-0.27	0.32-0.44	VII-VIII
Raymond			
	0.19-0.26	0.31-0.42	VII-VIII
Sierra Madre System			
Dunsmore	0.23-0.28	0.36-0.44	VII-VIII
San Fernando	0.17-0.20	0.27-0.32	VII
Sierra Madre	0.20-0.22	0.31-0.35	VII
Palos Verdes-Coronado Bank System			
Santa Monica Bay to LA Harbor	0.18-0.21	0.27-0.32	VII
San Gabriel (Western Part)			
	0.14-0.17	0.22-0.26	VI-VII
Anacapa-Dume			
	0.16-0.18	0.24-0.28	VII
San Andreas System			
Mojave Segment	0.08-0.09	0.12-0.13	VI

Notes: (1) Calculated for soil sites using weighted average (40%, 20%, 40%, respectively) of attenuation models of Abrahamson and Silva (1997), Boore, Joyner and Fumal (1997) and Sadigh et al. (1997). The reported maximum and minimum values reflect the varying distance from a given seismic source fault to the nearest and farthest points in the City, respectively.

(2) Approximate Modified Mercalli Intensity values corresponding with the calculated mean PHGA range, as indicated on Table 5 (Lindeburg, 1996).

TABLE 4B
RELATIVE IMPACT OF SELECTED EARTHQUAKES
ON THE CITY
(ROCK SITES)

Fault/Fault Segment Name	Estimated Mean PHGA (g) in West Hollywood⁽¹⁾	Mean + 1 Standard Deviation (g)	Modified Mercalli Intensity (MMI) for Mean PHGA⁽²⁾
Santa Monica System			
Hollywood	0.72-0.79	1.17-1.28	X
Santa Monica	0.70-0.77	1.13-1.24	X
Blind Thrust	0.37-0.38	0.57-0.59	VIII
Newport-Inglewood System			
Inglewood Segment	0.40-0.51	0.62-0.80	VIII-IX
Elysian Park Thrust			
Los Angeles Segment	0.34-0.41	0.55-0.65	VIII
Compton Thrust			
Baldwin Hills Segment	0.34-0.39	0.54-0.63	VIII
Verdugo-Eagle Rock System			
	0.24-0.34	0.38-0.54	VII-VIII
Puente Hills Thrust			
Los Angeles Segment	0.22-0.32	0.36-0.52	VII-VIII
Raymond	0.21-0.30	0.34-0.49	VII-VIII
Sierra Madre System			
Dunsmore	0.25-0.32	0.37-0.48	VIII
San Fernando	0.18-0.22	0.29-0.34	VII
Sierra Madre	0.20-0.24	0.30-0.37	VII
Palos Verdes-Coronado Bank System			
Santa Monica Bay to LA Harbor	0.19-0.22	0.28-0.35	VII
San Gabriel (Western Part)	0.13-0.16	0.21-0.25	VI-VII
Anacapa-Dume	0.16-0.18	0.24-0.28	VII
San Andreas System			
Mojave Segment	0.07	0.10-0.11	V

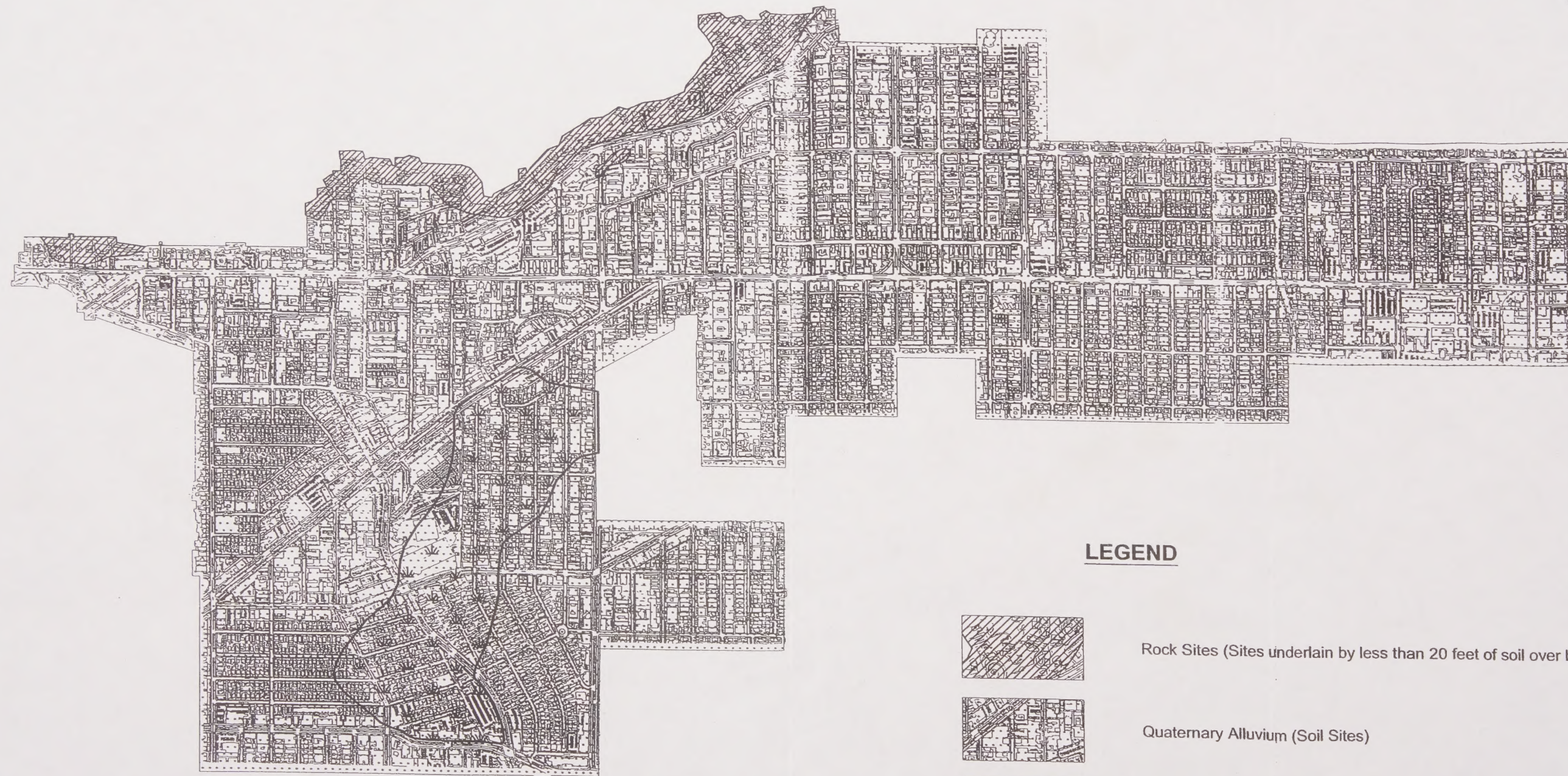
Notes: (1) Calculated for rock sites using weighted average (40%, 20%, 40%, respectively) of attenuation models of Abrahamson and Silva (1997), Boore, Joyner and Fumal (1997) and Sadigh et al. (1997). The reported maximum and minimum values reflect the varying distance from a given seismic source fault to the nearest and farthest points in the City, respectively.

(2) Approximate Modified Mercalli Intensity values corresponding with the calculated mean PHGA range, as indicated on Table 5 (Lindeburg, 1996).

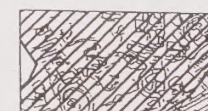
TABLE 5
MODIFIED MERCALLI INTENSITY SCALE

MMI	EFFECTS	PGA (g)	MAGNITUDE
I.	Not felt except by a very few, and only under special circumstances.	Less than 0.03	Below 3.0 magnitude on Richter Scale.
II.	Felt by persons at rest and on upper floors.	Less than 0.03	3.0-3.9 magnitude on Richter Scale.
III.	Felt indoors. Hanging objects swing slightly. Vibration feels like passing of light trucks. May not be recognized as an earthquake.	Less than 0.03	4.0-4.9 magnitude on Richter Scale.
IV.	Hanging objects swing noticeably. Vibration like passing of heavy trucks. Standing automobiles rock. Windows, dishes, doors rattle. Glasses clink. Wooden walls and frames creak.	0.03 and below	4.0-4.9 magnitude on Richter Scale.
V.	Felt outdoors by most people. Sleepers awakened. Liquids may spill. Small unstable objects displaced. Doors swing, close, open. Pictures move. Some breakage of plaster.	0.03-0.08	4.0-4.9 magnitude on Richter Scale.
VI.	Felt by all. Persons walk unsteadily. Windows, dishes, glassware broken. Objects, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry cracked. Small bells ring (church, school). Trees, bushes shaken visibly.	0.08-0.15	5.0-5.9 magnitude on Richter Scale.
VII.	Difficult to stand. Noticed by drivers of automobiles. Hanging objects shake. Furniture broken. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices; also unbraced parapets and architectural ornaments. Waves on ponds; water turbid with mud. Small slides and caving in along sand and gravel banks. Large bells ring. Concrete irrigation ditches damaged.	0.15-0.25	6.0-6.9 magnitude on Richter Scale.
VIII.	Steering of automobiles affected. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundation if not bolted down; loose panel walls thrown out. Branches broken from trees. Cracks in wet ground and on steep slopes.	0.25-0.45	6.0-6.9 magnitude on Richter Scale.
IX.	General panic. Masonry destroyed or heavily damaged. General damage to foundations. Frames cracked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground.	0.45-0.60	7.0-7.9 magnitude on Richter Scale.
X.	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.	0.6-0.8	7.0-7.9 magnitude on Richter Scale.
XI.	Rails bent greatly. Underground pipelines completely out of service. Damage severe to wood-frame structures, especially near shock centers. Few, if any, masonry structures remain standing. Large, well-built bridges destroyed by the wrecking of supporting piers or pillars.	0.8-0.9	8.0-8.9 magnitude on Richter Scale.
XII.	Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into air.	0.9 and above	8.0-8.9 magnitude on Richter Scale.

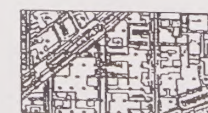
Source: Lindeburg, 1998



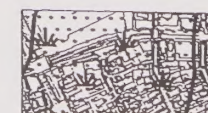
LEGEND



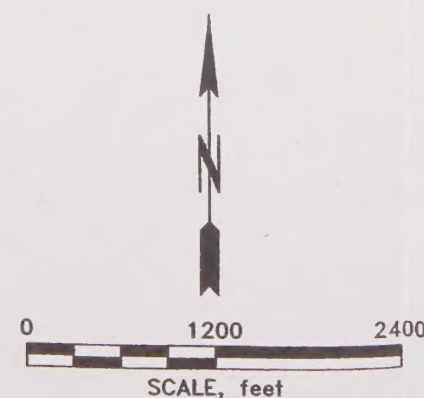
Rock Sites (Sites underlain by less than 20 feet of soil over bedrock)



Quaternary Alluvium (Soil Sites)



Location of Former Marsh (Based on 1920's-Era Topographic Mapping).
Potential Zone of Soft and/or Organic-Rich Sediments.



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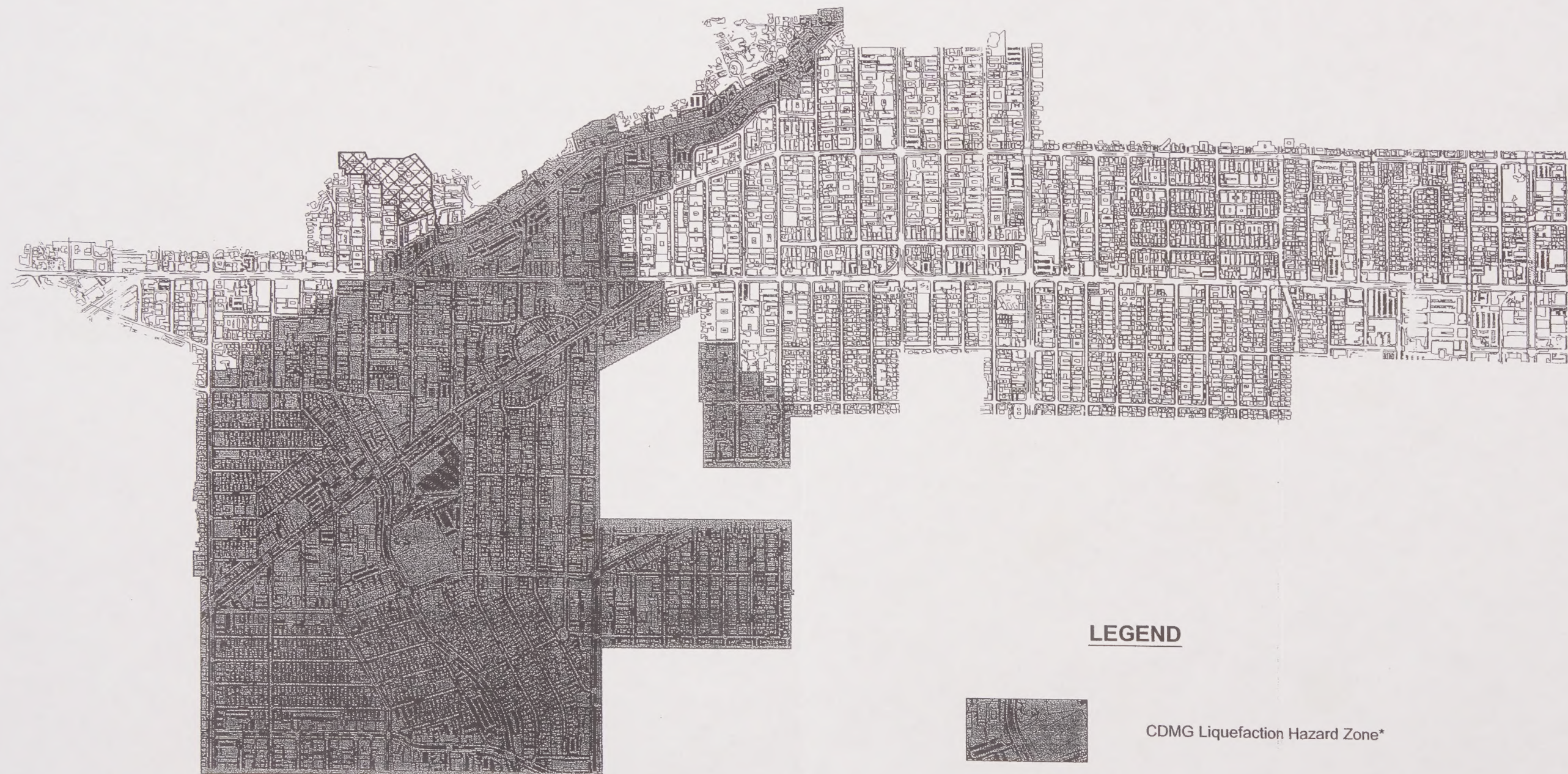
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Project Name: West Hollywood Safety Element

Project No.: 40.25093.0003

Date: August 2001

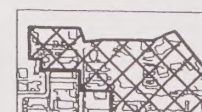
Map of Soil and Rock Sites
in the City of West Hollywood



LEGEND



CDMG Liquefaction Hazard Zone*



CDMG Landslide Hazard Zone*

*Note: Modified from March 25, 1999 maps of the Hollywood and Beverly Hills Quadrangles to include entire properties where mapped zone falls within any portion of the property.

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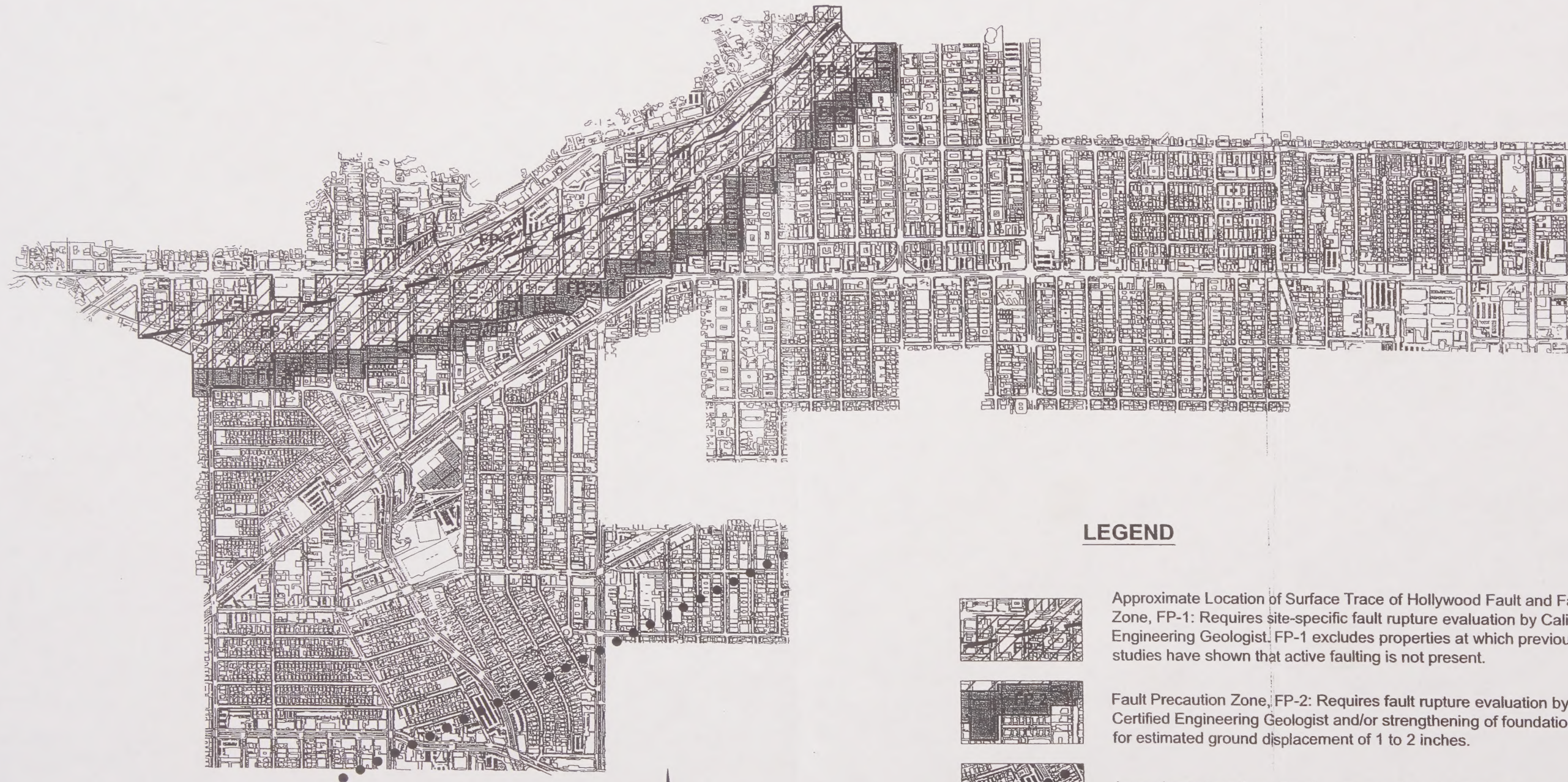
Project Name: West Hollywood Safety Element

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Date: August 2001

**Earthquake-Induced Liquefaction
and Landslide Hazard Map**

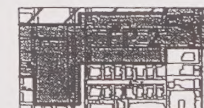




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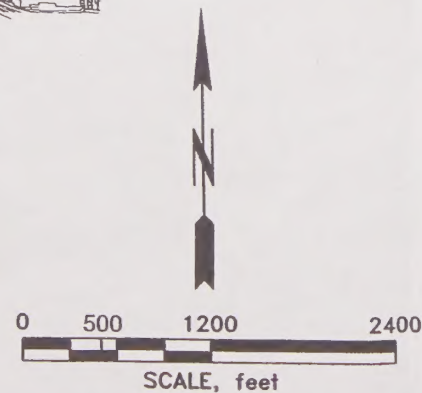
Approximate Location of Surface Trace of Hollywood Fault and Fault Precaution Zone, FP-1: Requires site-specific fault rupture evaluation by California Certified Engineering Geologist. FP-1 excludes properties at which previous fault evaluation studies have shown that active faulting is not present.



Fault Precaution Zone, FP-2: Requires fault rupture evaluation by California Certified Engineering Geologist and/or strengthening of foundations to provide for estimated ground displacement of 1 to 2 inches.



Approximate Location of Surface Trace of Santa Monica Fault: No special studies required at this time.



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Fault Location and
Precaution Zone Map

Figure 3





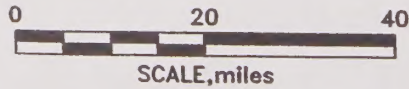
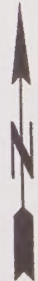
Explanations

Approximate location of active and potentially active faults, dotted where concealed, queried where conjectural.



Approximate surface projection of blind thrust fault. Open barbs represent the upper edge of blind thrust fault ramp; barbs point downdip

Fault locations based on: Greene and Kennedy (1987; 1988); Ziony and Jones (1989); Hauksson (1990); Wright (1991); Jennings (1994); Dolan, et al. (1995), Grant et al. (1999).





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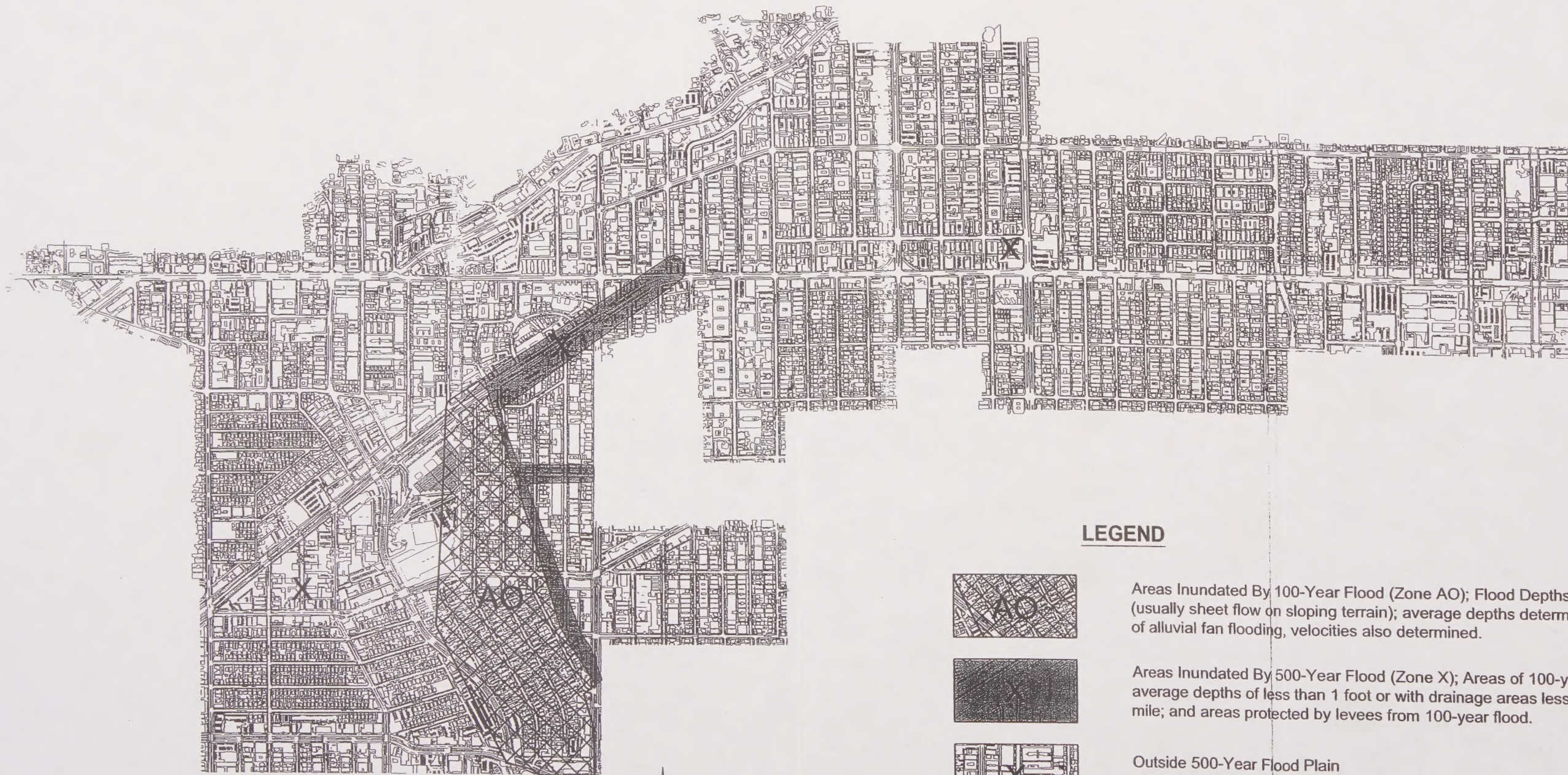
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Southern California
Fault Map

Figure 2





LEGEND



Areas Inundated By 100-Year Flood (Zone AO); Flood Depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.



Areas Inundated By 500-Year Flood (Zone X); Areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.



Outside 500-Year Flood Plain

Source: Flood Insurance Rate Map, Panel Number 0607200005A, June 18, 1987, rev. June 3, 1994



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FLOOD HAZARD MAP

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